Tutorial-4: Sunday, 23rd August 2020, 12:00-14:30 CET.

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Multi-Objective Optimization and Prototyping of Innovative Synchronous Reluctance Motors

Name: **Alberto Rubino (1); Emanuel Castagnaro (2)**
Institution: (1) SPIN Applicazioni Magnetiche, (2) Università degli Studi di Padova
E-mail: alberto.rubino@spinmag.it, emanuel.castagnaro@sphd.unipd.it

Tutorial Abstract:
Because of the uncertainty on the price of permanent magnets, Synchronous Reluctance Machines are currently seen as a potential alternative for PMSMs. Although they cannot reach the same power density, they are able to create high torques, are robust, easy to manufacture and have lower material costs. Unfortunately, these machines are also known to have low power factor and high torque ripples which can create noise. The aim of this tutorial is to present the basics of this type of machine, understand which are their main design parameters and how they impact the machine performance, looking particularly at the torque ripples. The influence of the control strategy and rotor shapes are studied. An innovative asymmetric structure is shown, analyzed and compared to more classical structures. Then the vibration aspects of the machine are also looked at. The theory and analyses made are illustrated through simulation results. The main ones are checked against measurements thanks to tests that have been performed on real prototypes. The benefits of using optimization methods and applying them to determine rotor shapes and minimize torque ripple will be demonstrated. In addition, it will be shown how multi-physics objectives and constraints can be considered in the optimization.

Biographies:

Mr. Alberto Rubino was born in Alba (CN), Italy, in 1992. He attended Electrical Engineering at Turin Polytechnic. He received B.Sc. in July 2014 and M.Sc. in December 2016. His fields of interest include the electromechanical conversion of energy, thanks to electrical rotating machines. He has been working for SPIN Applicazioni Magnetiche in Piacenza since March 2017. In SPIN he is in charge of electromagnetic design and thermal verification of several types of electric motors and drives, using both analytic and finite element software. He is also expert in system-level analyses, including control aspects.
He provided training courses to several companies, both regarding software utilization and theory of electrical machines.

Mr. Emanuel Castagnaro received the BS in Industrial Engineering in 2015 and the MS in Electrical Engineering in 2017 from the University of Pavia, Pavia, Italy. Currently he is a PhD student of the Department of Industrial Engineering at the University of Padova. His research interests are mainly focused on the NVH in synchronous machines, in particular in Synchronous Reluctance motors and Permanent Magnet motors.